

Investment in Natural Gas Pipelines in the Southern Cone of Latin America

Alejandro Jadresic

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Summary findings

Increasing demand for clean energy sources is expanding investment in natural gas infrastructure around the world. Many international projects involve pipelines connecting energy markets in two or more countries.

A key feature of investment taking place in Latin America is the convergence of gas and electricity markets. Many projects are being developed to supply gas to new power generation plants needed to meet electricity demand.

Construction of a pipeline over the Andes mountains to supply gas from Argentina to energy markets in central Chile was an idea long unfulfilled for political, economic, and technical reasons. Great changes have now taken place in a very short time.

Jadresic discusses both the achievements and the challenges to be faced by pipeline developers and Chile's energy sector. He details the benefits of the cooperative effort to consumers in terms of lower energy prices, higher environmental standards, and a more reliable energy system.

The experience in Latin America's Southern Cone shows how technological innovation, economic deregulation, and regional integration make it possible to build major international gas pipeline projects within a competitive framework and without direct state involvement.

This paper — a product of Private Participation in Infrastructure, Private Sector Advisory Services Department — is part of a larger effort in the department to analyze and disseminate the principles of, and good practice for, promoting competition in infrastructure. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Mina Salehi, room I10-118, telephone 202-473-7157, fax 202-522-2029, email address msalehi@worldbank.org. Policy Research Working Papers are also posted on the Web at www.worldbank.org/research/workingpapers. The author may be contacted at jadresic@creuna.cl. April 2000. (29 pages)

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Investment in Natural Gas Pipelines in the Southern Cone of Latin America

The natural gas pipelines between Argentina and Chile provide an interesting and valuable case study of large-scale investments in competitive environments. Jadresic, a former Minister of Energy in Chile argues that a competitive energy sector and free entry were important policy initiatives to spur the cross-border investments which have had a beneficial impact on the energy sector and the environment in Chile.

Alejandro Jadresic

INVESTMENT IN NATURAL GAS PIPELINES IN THE SOUTHERN CONE OF LATIN AMERICA

Alejandro Jadresic¹

1. Introduction

Increasing demand for clean sources of energy is expanding investment in natural gas infrastructure around the world. Massive resources are being allocated to extraction and processing plants, pipelines and other transportation means, distribution networks and equipment for end users. This investment process is also taking place in Latin America with major projects being developed in countries such as Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela. Many of these are international projects involving pipelines that interconnect energy markets in two or more countries.

2. The Underlying Forces

One of the key features of the investment process that is taking place in Latin America is the convergence of gas and electricity markets. Many of the projects are being developed to supply gas to new power generation plants that are required in order to meet increasing electricity demand.

In turn, convergence of gas and electricity markets in Latin America is explained by three basic forces (see Figure 1):

- (i) technological innovation; in particular, combined cycle generation plants fed with natural gas have become the most efficient and cleanest way of expanding the electricity system;

¹ Executive Director Jadresic Consultores Ltda. Former Minister of Energy of Chile (1994-98). Paper presented at the 1999 Annual Conference of the Harvard – Japan Project on Energy and the Environment held in January 1999 in Tokyo, Japan.

(ii) economic deregulation has opened the energy markets for private investment within a competitive environment,

(iii) regional economic integration and convergence of economic policies is making it much easier to develop international projects.

This situation has created great opportunities in the power and gas sectors as well as great challenges for governments and energy companies. Analyzing how these challenges have been met in Latin America can provide very useful lessons for other countries and regions, such as East Asia, that need to develop natural gas pipelines.

In what follows this document will focus in the pipelines that have been built in the Southern Cone of Latin America in order to supply natural gas from Argentina to Chile. They are a very interesting case since they have been developed entirely by the private sector within a competitive regulatory environment and with no state guarantees.

3. Investment in the Southern Cone of Latin America

The construction of a pipeline over the Andes mountains in order to supply gas from Argentina to energy markets in central Chile was an old idea that until recently had not been achieved due to political, economic and technical reasons. The political situation was a constraint since both countries had various disputes in the past regarding their international boundaries that brought them close to war twenty years ago. From an economic point of view, construction of a pipeline was a major challenge because the states did not have the money to finance such a project and the private sector did not have the incentives to do so. Technically, the project was a difficult task since it had to be built 3000 meters over the Andes mountains.

In a very short period of time things have changed dramatically. The first major project -the Gas Andes pipeline- started transporting gas to Santiago, in the central zone of Chile, in August

1997 and earlier that year a smaller one -the Magallanes pipeline- started to feed gas to a methanol plant located in the Magallanes Strait. Four additional projects are being built at present and will be operating before the year 2000: the Gas Atacama and Nor Andino pipelines will be transporting gas to the mining regions in the north of Chile, the Gas del Pacifico pipeline will distribute gas to the industrial city of Concepcion and a new pipeline loop will be sending more Argentinean gas to the methanol plant in Magallanes.

Overall investment in international pipeline projects between Chile and Argentina in the 1996-2000 period will be over US\$ 1.5 billion plus US\$ 0.5 billion corresponding to distribution networks in Chile. Including planned investment in combined cycle power generators and methanol plants total figures get close to US\$ 4 billion which is a very substantial amount for an economy as small as Chile (see Figure 2).

In order to explain how this scenario of strong gas interconnection between Chile and Argentina came about I will move five years back into the past and describe the challenges that were then being faced by the Chilean energy sector.

4. The Energy Challenge

Five years ago Chile was facing a major economic and environmental challenge: how to meet the rapidly increasing energy needs in a country that lacks domestic competitive sources of energy. Energy consumption was growing about 7% per year and it was expected that it would keep increasing at such rates since per capita consumption was still too small in comparison with other developing countries (see Figure 3).

New energy needs were being met primarily by importing more oil and coal, both of which accounted for slightly over 50% of total energy consumption (see Figure 4). Chilean production of oil had declined under 8% of domestic needs and the coal mines -which still accounted for about one third of the market- were closing due to very high costs of production and high sulfur content. On the other hand there were increasing economic and environmental constraints in expanding hydroelectric capacity and utilization of firewood as a fuel whereas domestic natural

gas reserves were located south in the Magallanes Strait, too far from the main consumption centers in central and northern Chile.

The challenge was even more acute in the power industry where consumption was growing about 8% per year (see Figure 5) and due to economic and environmental limitations it was becoming more difficult to build new hydroelectric and coal plants both of which accounted for about 90% of the generation matrix (see Figure 6).

Moreover, the Chilean energy system was very isolated and autarkic. Even though we imported most of the oil and coal that we consumed, our electric grids were not interconnected with energy-rich Argentina and we did not have oil or gas pipelines going across the Andes mountains (see Figure 7).

5. The Regulatory Framework

Notwithstanding the limitations of geography, Chile had taken important steps in modernizing its energy sector. In fact Chile was a pioneering country in deregulating and privatizing its power industry.

5.1 The Electricity Industry

In 1982 a new law restructured the electricity sector. It unbundled generation, transmission and distribution activities and introduced competition among different generators. A pool system was created in order to coordinate load dispatch. A marginal cost pricing scheme was introduced to value load transactions between generators and a price cap mechanism was introduced to regulate prices charged to small customers. Later in the eighties the two main state owned companies were privatized as well as several regional utilities.

Deregulation and privatization of the electricity sector had resulted in efficient operation and a high level of private investment. There was however the feeling that there was not enough competition in the market due to a relatively high degree of market concentration, a high level

of vertical integration and the accumulation of the main water rights in just one generation company. As a consequence prices still remained high in comparison with international standards.

5.2 The Gas Industry

Regarding the gas industry, not much had happened primarily because Chile did not have gas reserves except far south in Magallanes where it was used for some industrial purposes and to supply energy to the city of Punta Arenas. LPG was the dominant source of gas for domestic consumers (see Figure 8).

As was said before, the idea of building a gas pipeline across the Andes had not succeeded but starting in 1990, after diplomatic relations had improved (a Mutual Friendship Treaty was signed in 1984) and democratic governments had been installed in both countries some steps forward were taken. In that year there was an attempt by both governments to call an international bid to allocate the project to a group of investors but it failed primarily because it was not clear how to choose among different bidders and under what rules the project would operate after construction. Later, in 1991 a Gas Interconnection Protocol was signed between the two countries stating some conditions for private investors interested in building and operating a pipeline, such as the following: (i) it left it to buyers and sellers to negotiate the price of gas, (ii) pipelines should operate under open access conditions, (iii) a maximum quota was set for gas exports from Argentina, and (iv) gas should originate from the Neuquen Basin in Argentina. Within this framework the Transgas international consortia started to study the project and obtained a permit to export gas from Argentina. Some time later a second group of companies started studying the Gas Andes pipeline, an alternative project to transport gas from Argentina to Chile.

6. The Energy Policy

The administration of President Eduardo Frei that took office in 1994 announced that its energy policy would seek to satisfy Chile's increasing energy needs in a way that would protect the

environment and the rights of consumers. Consequently the energy policy would be based on three basic objectives.

The first objective was to promote private investment both from Chilean and foreign companies. That would require clear, simple and stable rules that had to be established in legislation.

The second objective was to promote market competition both among different companies and among energy sources, since competition is the best guarantee for efficiency in production and consumer welfare.

The third objective was to protect the environment and to ensure that energy projects minimized their environmental and safety-related impacts. Prevention was to be a key principle for energy development.

Based on these three principles several decisions were made regarding the electricity and gas sectors.

6.1 Electricity Policy

State owned companies still had an important participation in the power industry. COLBUN, the state-owned generator, owned 12% of the generation capacity of the SIC (Central Interconnected System) while the generation division of CODELCO (the leading Chilean copper producer) accounted for 55% of the capacity of the SING (Northern Interconnected System). It was decided that both generators would be privatized but with some constraints in order to ensure that they would be bought by new entrants and investment plans would not be delayed. It was hoped that competition would intensify and larger investment projects would follow. Accordingly the energy division of CODELCO was sold in 1996 and the sale of COLBUN followed in 1997.

The principles of the 1982 electricity law were correct but some of its norms and regulations lacked clarity, were obsolete, caused conflicts among companies or made it difficult for new investors to enter the industry. It was decided that a general ruling (“reglamento”) of the electricity law would be prepared in order to improve norms on issues such as dispatch coordination, payment of transmission fees and quality of service standards. These new norms would facilitate competition in the market place. The new ruling was enacted in 1997 and started to be applied in 1998.

New norms would also be sought regarding water rights so that companies requesting such rights would be forced to hand them back to the water authority or sell them if they were not used in new hydroelectric projects. Since it would take some time until Congress could analyze and approve such reform, a request was filed to the antitrust commission, which in 1996 stated that the water authority could only grant new water rights to companies that could ensure that they would build new projects.

Last, a special effort would be made so that natural gas coming from Argentina could be used on equal terms by any power generation company. Natural gas was considered a key element to lift entry barriers and promote competition in the power generation market, provided that pipelines were built and open access to transportation services could be enforced. In order to do so a proper regulatory framework had to be established.

6.2 Natural Gas Policy

Natural gas was considered to be essential not only to promote competition in the electricity market but to diversify the sources of energy supply, to protect the environment and to improve efficiency of the energy sector. Fulfillment of such objectives required that natural gas could compete on equal terms with other fuels.

Negotiations were started with the Argentinean energy authorities in order to liberalize the gas interconnection protocol. By 1995 an agreement was reached which lifted all constraints regarding volume of gas to be exported from Argentina as well as the basin where it should be

produced. According to this new agreement there would be as many pipelines as the private sector was willing to finance, yet they should operate under open access conditions. Prices of gas and terms of supply would be negotiated directly between buyers and sellers of gas.

Regulatory norms were prepared in Chile in order to enforce open access to transportation services and to allow pipeline developers to obtain rights of way over private or state land. Such norms were included in a Concessions Ruling which was established in 1995. Another ruling was dictated the same year in order to impose safety standards and quality requirements to pipelines and distribution networks so that people and physical installations would not be endangered.

Additional norms were established forcing manufacturing industry located in Santiago to severely reduce atmospheric emissions by 1998. The purpose was to reduce the air pollution levels in Santiago and indirectly to provide incentives for industry to shift to natural gas as a fuel or alternatively to spend on expensive filters or other environmentally sound technologies.

7. The Outcome

The private sector reacted promptly to the policy incentives established by the government and in a very short period of time several projects were started. I will briefly refer to two very interesting cases.

7.1 The Transgas – Gas Andes Dispute

The first case is the fierce market dispute that took place between two international consortia that wanted to build the first pipeline to supply natural gas to power generators and gas distribution companies located in Central Chile.

Transgas was a consortium led by Enersis, the largest Chilean electricity holding. Major partners were Tenneco Gas, from the United States and British Gas, from the United Kingdom. The former was supposed to be the operator of the pipeline and the latter would become the

operator of a company that would be created to distribute gas in Santiago and other cities. Minor partners were YPF, the largest Argentinean oil and gas company, and ENAP, the state owned Chilean oil company. The idea of Transgas was to build a pipeline that would traverse the Andes from the Neuquen basin to Concepcion and then would move north to supply gas to Santiago, Valparaiso and other Chilean cities. Total investment was planned to be just US\$ 600 million in the pipeline plus additional resources to build distribution networks and combined cycle plants in Chile (see Figure 9).

Gas Andes was a consortia led by Novacorp from Canada. Major partners were Chilgener (later called Gener) the second largest Chilean power generator, and Gasco, an old Chilean company which distributed city gas in Santiago and LPG in several Chilean cities. Novacorp would become the pipeline operator and Gasco would become the major shareholder of Metrogas, a new distribution company which would absorb the city gas grid in Santiago. Minor partners were Copec, the largest Chilean gasoline retailer, and CGC, an Argentinean energy company. Gas Andes had originated when Chilgener and Gasco decided to create an alternative project that would compete with Transgas. Their idea was to build a pipeline that would bring gas to Santiago directly from Mendoza, where it would interconnect with the Argentinean pipeline system. Extensions would be built to Valparaiso and other places in Chile. Total investment in the pipeline would be US\$ 325 million not including extensions in Chile, distribution networks or generation plants.

Transgas and Gas Andes entered into an intense competitive race trying to sign gas transportation contracts that would allow them to finance their projects. Since the rules set by the government forced them to offer the same conditions to all customers, transportation price and guarantees backing transportation services became the main competitive tools. Open access regulations required that they established an “open season” period during which customers would file for transportation services; the pipeline consortia would then announce their price and other service conditions.

The commercial dispute caused the transportation price offered by both pipeline consortia to decline until it reached a competitive level. The dispute was solved when the three main Chilean

power generators, Endesa, Chilgener and Colbun, decided to sign transportation contracts with Gas Andes in order to feed natural gas to combined cycle generation plants that each one decided to build. Interestingly, Endesa signed a contract with this pipeline even though its major shareholder was Enersis, the leader of the Transgas project. Open access acted as a safeguard for a power company that was involved in the project that lost the competitive race.

The Gas Andes project started to be built at the beginning of 1996 once the environmental impact assessment study was approved and began to transport gas to a power plant and the grid of Metrogas in Santiago in August 1997. An extension to Valparaíso was built one year later by the power companies Endesa and Colbun allowing them to operate their own power plants and to supply gas to two newly formed gas utilities, Gas Valpo and Energas, which are still competing to sign contracts with industrial and residential users in that zone.

As a result of the fierce competitive race between Transgas and Gas Andes a new clean source of energy was introduced to Central Chile. There was an immediate pro-competitive effect in the Central Interconnected System (SIC) which accounts for almost 80% of the Chilean market. In fact the wholesale price of electricity in Santiago has declined over 35% in real terms since 1994. Natural gas has become an effective competitor to hydroelectricity and coal, the two traditional sources of power in the central system (see Figure 10).

Natural gas also had a strong impact on the manufacturing sector. Just one year after it was introduced in Santiago it accounted for around 40% of total consumption of energy (excluding electricity) by industrial users in that city. It has been estimated that by 2005 that share will reach up to 70% (see Figure 11). Tighter environmental norms for atmospheric emissions have been a very strong incentive for gas penetration. In fact, natural gas will allow large reductions in industrial emissions of the main sources of air pollution: around 62% for particles, 33% for NO_x and 79% both for SO₂ and CO.

7.2 The Gas Dispute in Northern Chile

The second case to be presented is the market dispute that is taking place in northern Chile in order to supply power and energy to the mining region in the area. Even though the Northern Interconnected System (SING) accounts for just 20% of Chilean power consumption, it has been the most dynamic energy market in recent years -growing at about 15% per year- due to large investments in new mining ventures.

Until the early 1990s the SING was dominated by two state-owned companies: the power division of the copper producer Codelco and Edelnor, owner of some power units and transmission lines. Coal, and to a lesser extent, oil, were the main sources of energy. Due to the lack of water, the lack of other energy resources and to high transportation costs, the prices of electricity were much higher than in the rest of the country.

Things started to change with the privatization of Edelnor, in 1993, and Codelco-Tocopilla, in 1996 and investments in new coal operated plants made by Endesa and Gener, the two largest generators from the central system. Competition was strengthened and the wholesale price of electricity started to decline.

The 1995 gas agreement with Argentina and the realization that both gas and electric interconnection were feasible (a preliminary electric interconnection agreement was signed in 1997) further promoted competition. Accordingly three different projects were defined: the Gas Atacama pipeline, the Nor Andino pipeline and the Inter Andes transmission line (see Figure 12).

Gas Atacama is led by a partnership between Endesa and the american company CMS, is to be the pipeline operator. Their purpose is to build a US\$ 350 million pipeline from Salta to Mejillones to supply gas to combined cycle generation plants as well as to industrial users and a water desalinization plant. Gas Atacama wants to build its own power plants allowing other customers to contract transportation services on its pipeline.

Nor Andino is an alternative US\$ 330 million pipeline project designed to transport gas from Salta to Tocopilla. It is led by the Belgian company Tractebel which is the owner of ElectroAndina, formerly the electricity division of Codelco. Another partner in Nor Andino is Southern Electric, from the United States, which has controlled Edelnor since the time it was privatized. Both ElectroAndina and Edelnor want to build their own power plants leaving the pipeline open for third parties to transport gas from Argentina.

Inter Andes is a transmission line project developed by Gener. Its purpose is to interconnect two combined cycle power plants to be built in Salta by itself with the copper mines and other electricity consumers located in northern Chile.

A fierce competitive battle has developed among the three projects in northern Chile pushing downwards the price of power agreed in long term contracts between generators and mining companies. Even before any of the projects had actually been completed the price of electricity in real terms at the end of 1998 was almost 50% below the level it had been 5 years ago(see Figure 13).

Interestingly and unlike what happened in central Chile, the three projects are going ahead and should be operating by 1999. Still it is unlikely that all the combined cycle generation plants that have been planned will actually be built, at least at the dates that were initially estimated. Moreover, the developers of the two pipeline projects –Gas Atacama and Nor Andino- have started negotiations in order to coordinate the operations of the pipes so as to minimize costs. Yet it is clear that customers have greatly benefited from the coming introduction of natural gas in northern Chile.

8. The Energy scenario in the Future

The international gas pipeline projects developed in central and northern Chile plus the projects that are being developed to supply gas from Argentina to Concepcion and Magallanes are changing the structure of the Chilean energy sector. In just five years what used to be an isolated system has become an energy market, interconnected with Argentina through gas pipelines,

electricity transmission lines and, since 1994, by an oil pipeline that transports oil from Neuquen to a refinery located near Concepcion. By the year 2000 the Chilean energy map should look like Figure 14, very different from the map shown in Figure 8. The creation of new alternatives of supply will significantly strengthen the reliability and flexibility of the energy system.

The energy interconnection with Argentina will have a major on the Chilean energy mix. It has been estimated that by 2005 natural gas will represent 23% of the country's primary energy source, up from 7% in 1994, reducing the proportion of oil and coal (see Figure 15). The impact will be greater in the power sector since the construction of combined cycle plants should increase the participation of natural gas in the generation mix up to 28% in 2005, a significant jump from 1% in 1994. In addition to that, electric interconnections should account for about 3% of power supply. Hydroelectricity will continue being the main source of power, but its share should decline to about 40% (see Figure 16) thus reducing the vulnerability of the Chilean electric system during severe drought.

Lower energy prices and more vigorous competition will be very important byproducts of the developments in the natural gas industry. As was shown in the two cases covered in this document, prices have already declined significantly in the power sector, benefiting mining, manufacturing as well as other industrial and residential consumers. Competition has also been strengthened in the market for gas and liquid fuels in response to attempts by the gas utilities to contract with new customers.

A cleaner environment is an additional side effect of the introduction of natural gas to the Chilean energy market; in fact environmental protection was one of the objectives of the energy policy. Manufacturing plants in air-polluted Santiago have already shifted to the new fuel and there are plans to promote utilization of natural gas by buses and other motor vehicles. Other cities in Chile should be following a similar path.

The experience in the Southern Cone of Latin America shows that technological innovation, economic deregulation and regional integration is making it possible to build major

international gas pipelines projects within a competitive framework and without direct involvement by the states. Furthermore, such a framework can bring about great benefits to the consumers in terms of lower energy prices, higher environmental standards and a more reliable energy system.

Figure 1

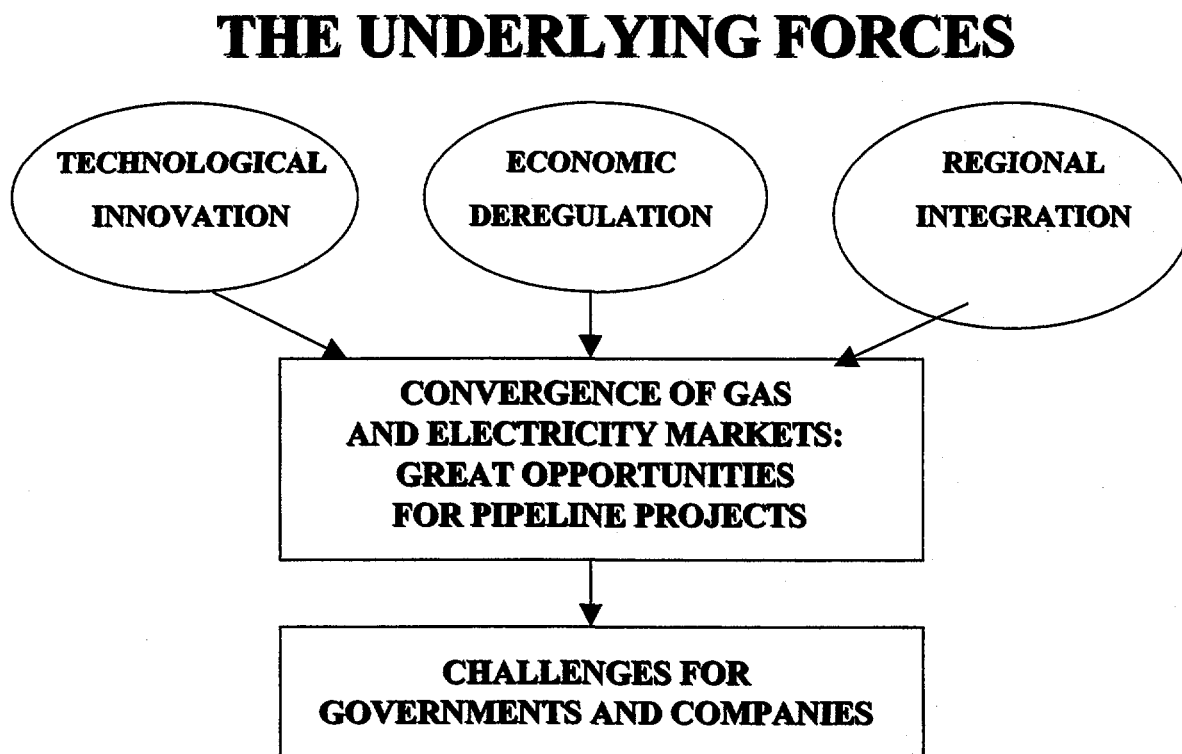


Figure 2

GAS PIPELINE PROJECTS IN CHILE

(figures in US\$ millions)

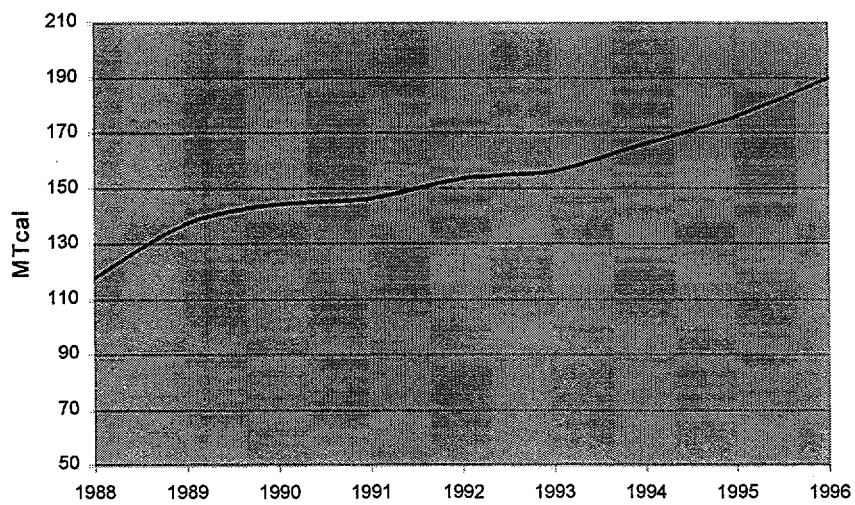
| PIPELINES BETWEEN ARGENTINA AND CHILE | | |
|---------------------------------------|-------------------------|--------------|
| YEAR | PROJECT | INVESTMENT |
| 1996 | Magallanes | 30 |
| 1996-1997 | Gas Andes | 325 |
| 1997 | Electrogas extension | 88 |
| 1998 | Magallanes 3rd loop | 30 |
| 1998 | Gas Atacama | 350 |
| 1998 | Nor Andino | 330 |
| 1998-1999 | Gasoducto del Pacifico | 350 |
| | Total | 1.503 |
| DISTRIBUTION NETWORKS | | |
| 1996-2000 | Metrogas | 400 |
| 1998-2000 | Energas | 44 |
| 1998-2000 | GasValpo | 42 |
| 1999-2000 | GasSur | 46 |
| | Total | 532 |
| POWER PLANTS AND END USE EQUIPMENT | | |
| | C.C. Power plants SIC | 565 |
| | C.C. Power plants SING | 900 |
| | Methanol plants | 65 |
| | Total | 1.930 |
| | Total investment | 3.965 |

SOURCE: NATIONAL ENERGY COMMISSION

Figure 3

CHILEAN ENERGY SECTOR: THE INITIAL SITUATION

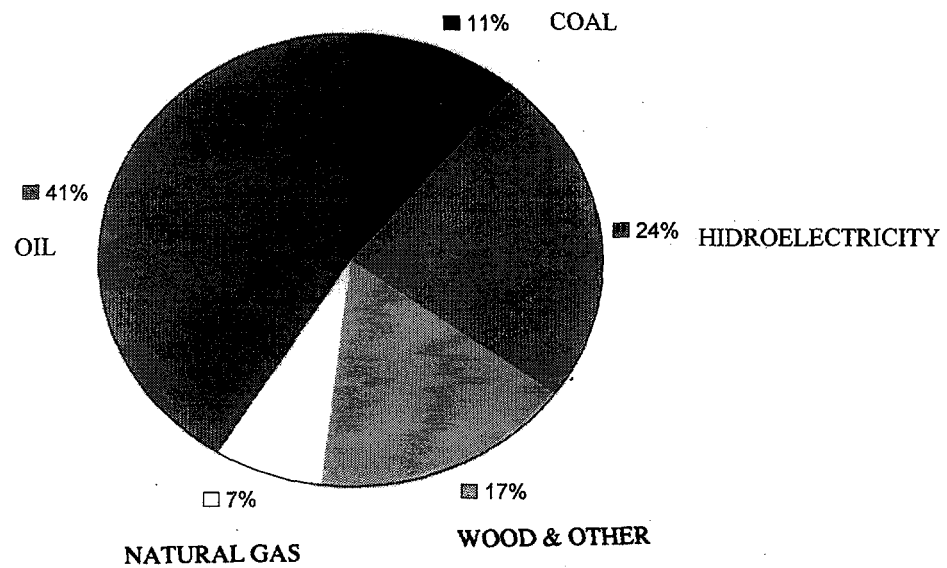
ENERGY CONSUMPTION



SOURCE: NATIONAL ENERGY COMMISSION

CHILEAN ENERGY SECTOR: THE INITIAL SITUATION

THE ENERGY MATRIX (1994)

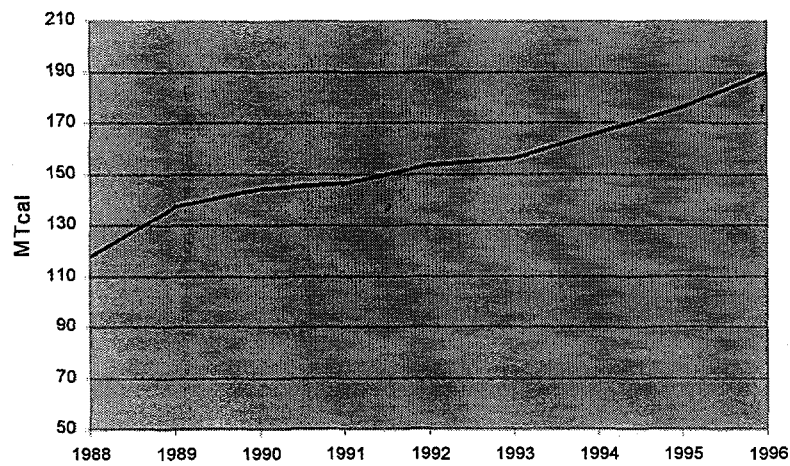


SOURCE: NATIONAL ENERGY COMMISSION

Figure 5

CHILEAN ELECTRICITY SECTOR: THE INITIAL SITUATION

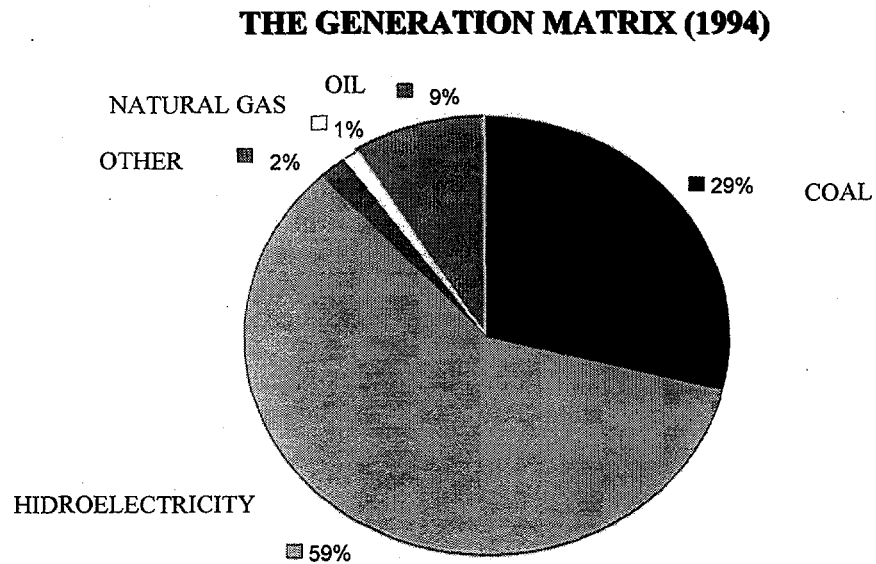
ELECTRICITY CONSUMPTION



SOURCE: NATIONAL ENERGY COMMISSION

Figure 6

CHILEAN ELECTRICITY SECTOR: THE INITIAL SITUATION



SOURCE: NATIONAL ENERGY COMMISSION

Figure 7

THE CHILEAN ENERGYSYSTEM (1994)

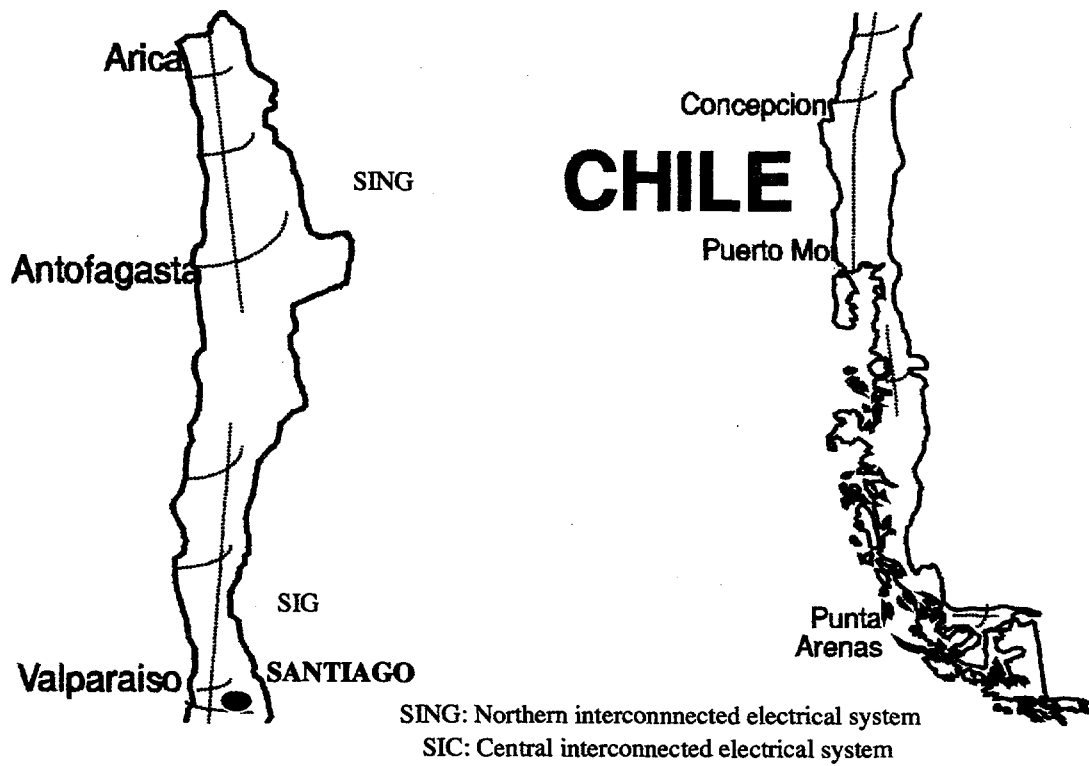


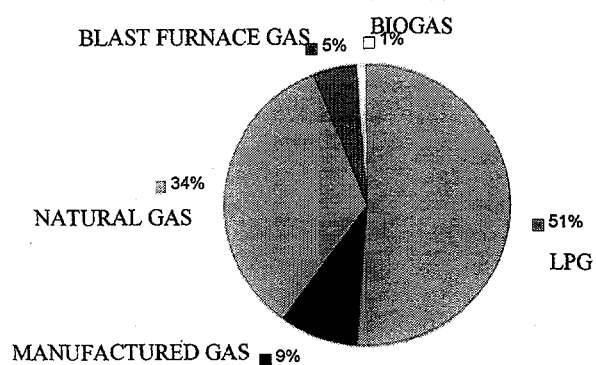
Figure 8

PRODUCTION AND CONSUMPTION OF GAS IN CHILE Year 1996

| Type | Production Millions m ³ * | Energy Consumption Millions m ³ * |
|-------------------|---|---|
| Natural Gas | 3.632 | 774 |
| Manufactured Gas | 507 | 486 |
| Blast Furnace Gas | 1.692 | 1.313 |
| Biogas | 77 | 77 |
| LPG | 466 | 897 |

* LPG in ton millions

PARTICIPATION IN ENERGY CONSUMPTION Year 1996



Total 21.516 Teracal

SOURCE: NATIONAL ENERGY COMMISSION

Figure 9

THE TRANSGAS - GASANDES DISPUTE

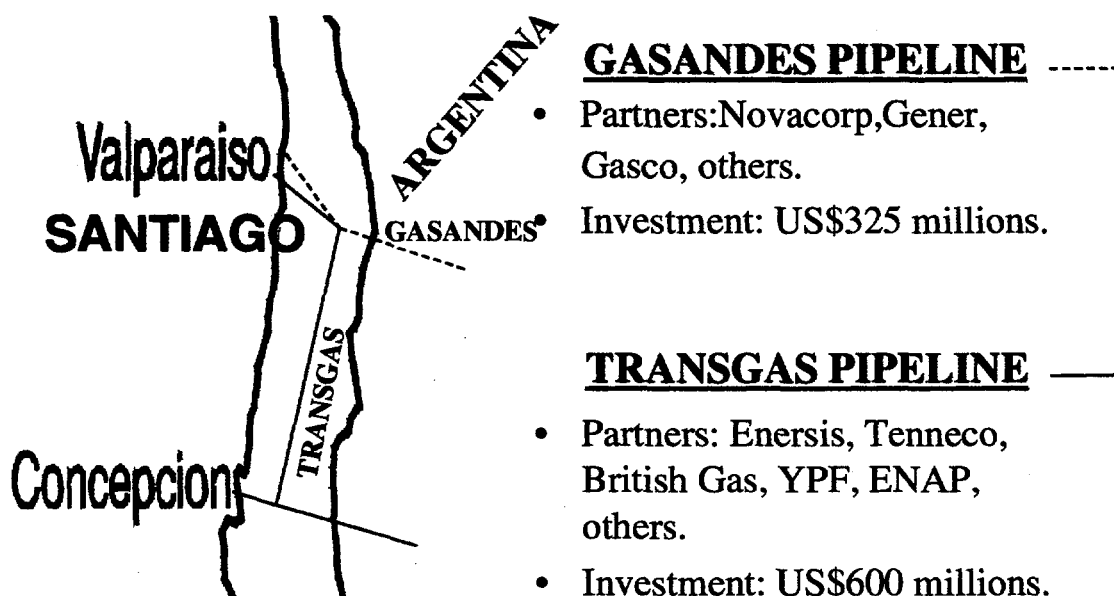
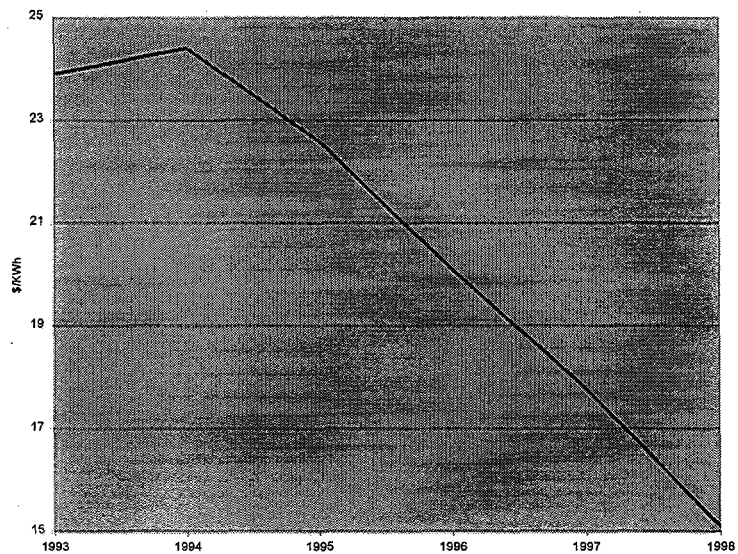


Figure 10

THE TRANSGAS - GASANDES OUTCOME

| INVESTMENT | | |
|-------------------------------|-------------|--------------|
| YEAR | PROYECT | INVESTMENT |
| Pipelines: | | |
| 1996-97 | Gasandes | 325 |
| 1997-98 | Electrogas | 88 |
| Distribution grids: | | |
| 1996-99 | Metrogas | 400 |
| 1997-98 | Energas | 44 |
| 1997-98 | GasValpo | 42 |
| Combined cycle plants: | | |
| 1997 | Nueva Renca | 215 |
| 1998 | Nehuenco | 170 |
| 1998 | San Isidro | 180 |
| TOTAL : | | 1.464 |

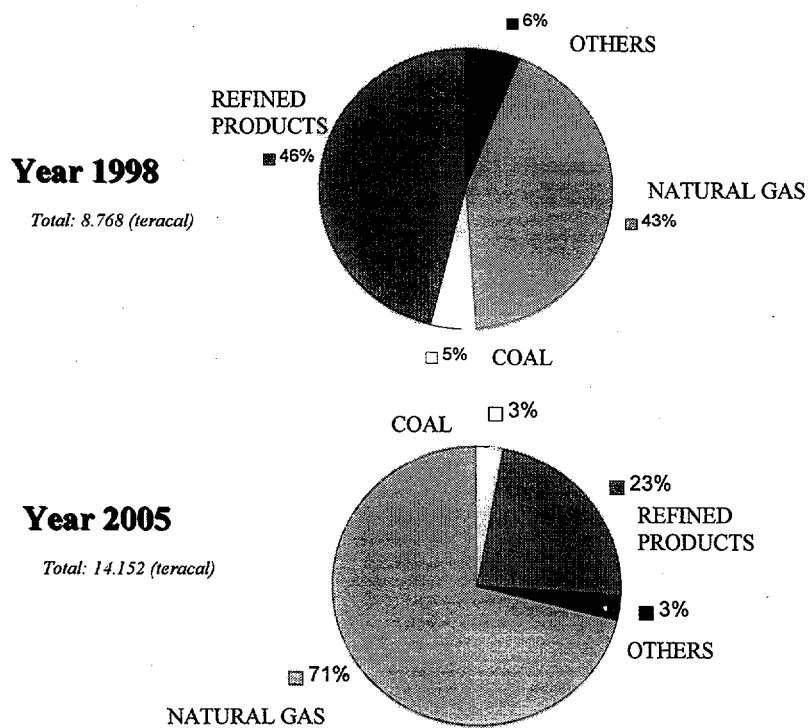
ELECTRICITY PRICES



SOURCE: NATIONAL ENERGY COMMISSION

Figure 11

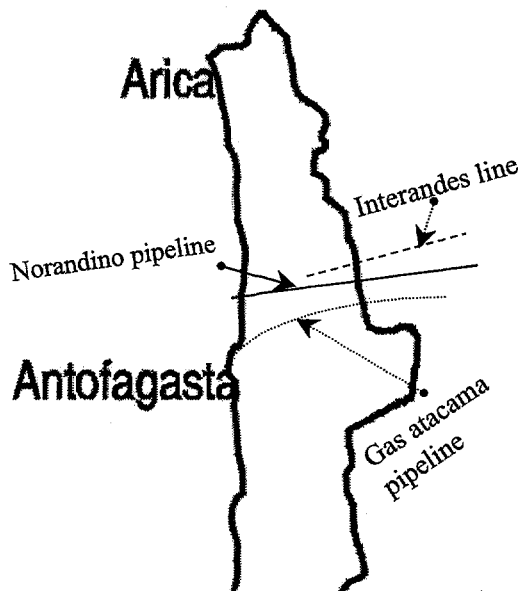
INDUSTRIAL DEMAND OF FUELS
Metropolitan Region



SOURCE: NATIONAL ENERGY COMMISSION

Figure 12

THE NORTHERN CHILE DISPUTE



GAS ATACAMA PIPELINE

- Partners: Endesa and CMS.
- Investment: US\$ 350 millions

NORANDINO PIPELINE

- Partners: Tractebel, Southern Electric.
- Investment: US\$ 330 millions

INTERANDES LINE

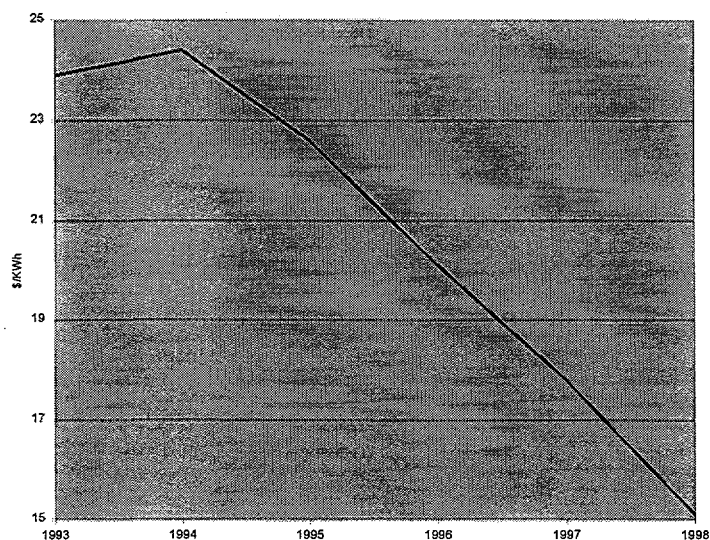
- Partners: GENER.
- Investment: US\$ 160 millions

Figure 13

NORTHERN CHILE: THE OUTCOME (SO FAR)

| INVESTMENT | | |
|--------------------------------|----------------|--------------|
| YEAR | PROYECT | US\$ million |
| Pipelines : | | |
| 1998-99 | Gas Atacama | 350 |
| 1998-99 | Nor Andino | 330 |
| Transmission line : | | |
| 1998-99 | Inter Andes | 160 |
| Combined cycle plants : | | |
| 1999 | NOPEL | 150 |
| 1999 | NOPEL | 150 |
| 1999 | Electro Andina | 100 |
| 1999 | Inter Andes | 100 |
| 1999 | Inter Andes | 100 |
| 1999 | Inter Andes | 100 |
| 2000 | Electro Andina | 100 |
| 2000 | Edelnor | 100 |
| | TOTAL : | 1.740 |

ELECTRICITY PRICES



SOURCE: NATIONAL ENERGY COMMISSION

Figure 14

THE CHILEAN ENERGY SYSTEM : 2000

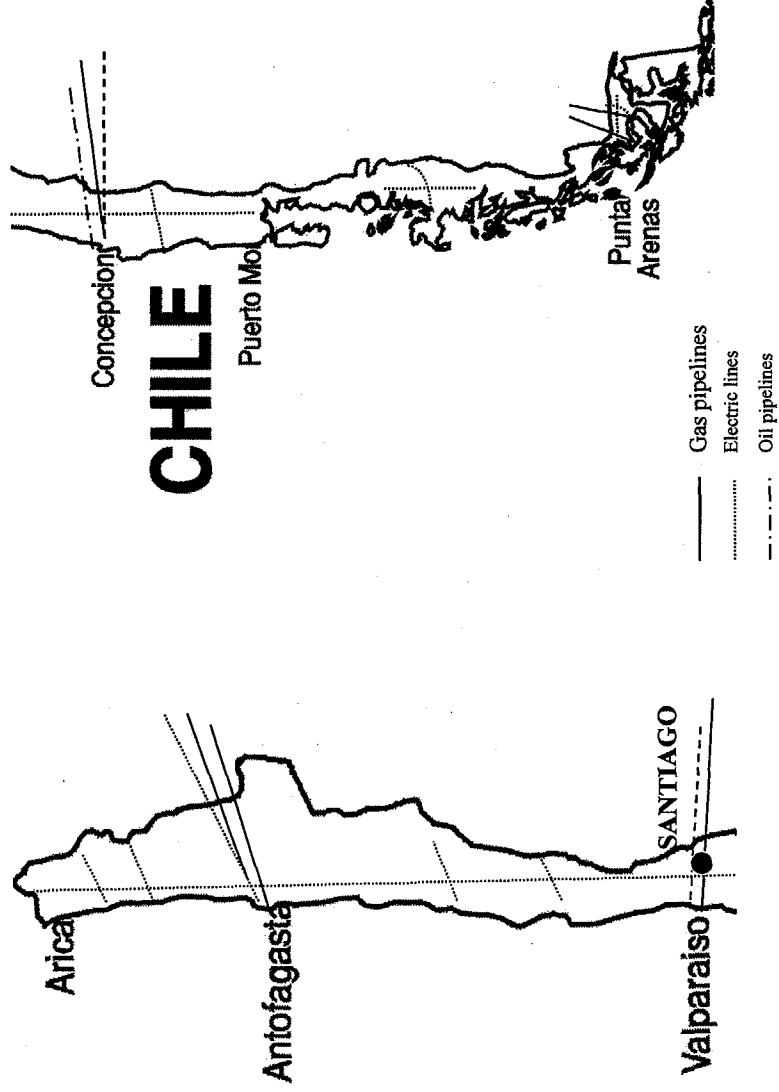
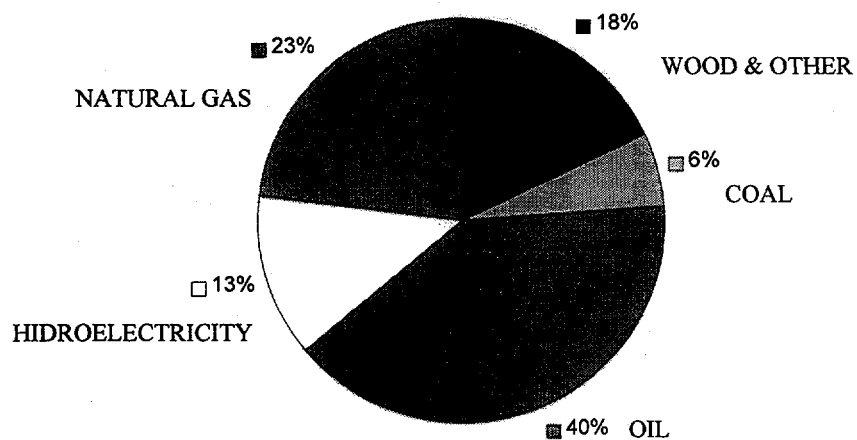


Figure 15

CHILEAN ENERGY SECTOR : IN THE FUTURE (2005)

THE ENERGY MATRIX

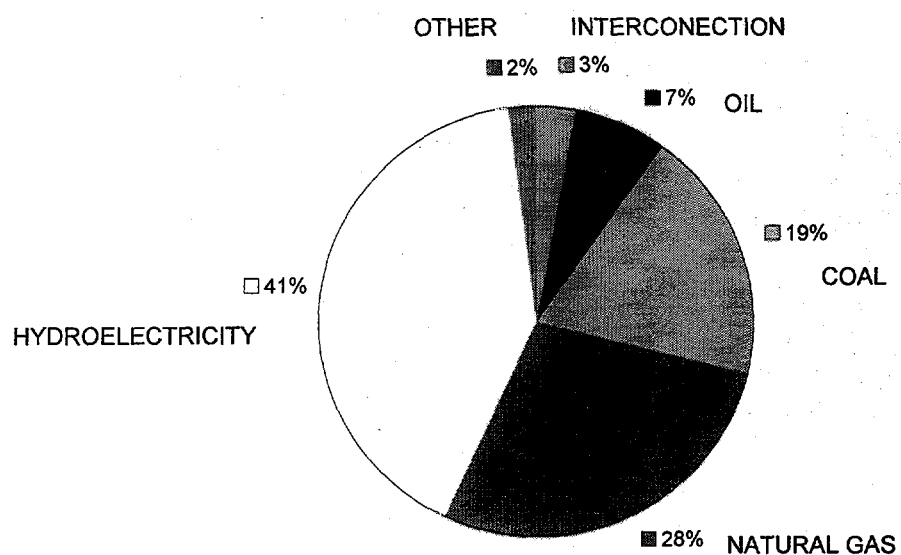


SOURCE: NATIONAL ENERGY COMMISSION

Figure 16

CHILEAN ENERGY SECTOR : IN THE FUTURE (2005)

THE GENERATION MATRIX



SOURCE: NATIONAL ENERGY COMMISSION

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4/26